A STUDY OF NEW ENGLAND MORTALITY.

By Harry A. Richards.

The study of mortality tables has always disclosed interesting facts as to the life of a community. William Farr, the eminent English statistician, has set forth in many places in his reports the advantages of their use, and has constructed many valuable tables. Such tables and deductions from them have been made, indeed, in the other leading European countries. But in the United States adequate statistics on which to base them have been, until very recent years at least, wholly lacking. Some records of deaths and births, and of population, are to be found, however, in New England, extending back to the earliest times. I have attempted to make some use of these data, and to criticise my own results in such a way as to be sure of not proving too much. It is not without utility to prove that nothing can be proved, if no better result can be reached.

The prevalent notion is that conditions favoring longevity are increasing, and this is probably correct in respect of recent times. That it was so uniformly, from the settlement of New England, is certainly open to doubt. Professor Bailey, in his "Modern Social Conditions," says, after giving Wigglesworth's life-table for Massachusetts constructed in 1793 or thereabouts (see Table IV) and the Board of Health Table for Massachusetts constructed in 1897 (see Table II), "We see from this table that in the course of a century the expectation of life at birth has increased sixteen years for males and eighteen for females, assuming that the figures for males and females are identical at the earlier date." This sort of comparison is of doubtful value, for it does not take into account the fact that the two tables were constructed on entirely different principles. Wigglesworth himself knew the limitations of his work very well, and in fact made a correction for the

earlier ages of his table, which makes Professor Bailey's comparison inaccurate, even on the face of the tables, not regarding the difference in method. In my own investigation I have tried to keep such differences in mind and to discount them.

First, let us inquire as to the change in the force of mortality during the last half-century (see Table II). The table of 1897 and Elliott's table of 1855 were both constructed on the correct principle, comparing the actual deaths with the actual living population. A comparison of them is therefore permissible. This comparison discloses the fact that mortality has lessened most markedly in the years of infancy and childhood, and to a less degree in later life. The results are well stated in the Report of the State Board of Health for 1897. Table III presents the same facts, in the form of death-rates. These two tables are the only ones that can be considered finished products, based on adequate data. They seem to show an increasing expectation of life and a saving of many years of existence to the population.

The next preceding effort to make a historical study of mortality that I have found was Lemuel Shattuck's Essay on the Vital Statistics of Boston from 1810 to 1849 (see Table V). He says: "It has been repeatedly said that the great improvements in the science of medicine—in the nature and treatment of disease, and other causes, have increased the average longevity of mankind; that life is more valuable now than it formerly was; and that these improvements are constantly going on. The value of life is estimated by the number of years we live. A long life is more valuable than a short one. It is said to be improved in value when the various circumstances, which surround us, add to the number of years of existence, as compared with other causes, which have existed in other places or periods of time. No correct conclusion can be made in regard to such comparison, except by careful examination of the facts.

"This comparison . . . shows that, although the average value of life is greater now than during the last century, it is not so great as it was twenty years ago."

This is a clear and valuable statement of what investigations

of this kind can prove, and it is also valuable as an interpretation of the results he was able to get from the bills of mortality of Boston. These show a positive decrease in the expectation of life during the period of his observations. He accounted for this by overcrowding, by the prevalence of "luxury and effeminacy," and by the heavy infant mortality. At any rate, here was a time when a steady betterment of conditions conducing to longevity was not the rule.

The next table before this was Wigglesworth's, published in 1793, constructed from deaths alone, and used for many years in Massachusetts courts as an authority on American mortality. Data were also collected by President McKean, of Bowdoin College, which I have cast into a form of a mortality table (see Table VI).

The extant tables, then, carry us back about one hundred and twenty years or thereabouts. What was the change which took place during the century and a half before that, from the founding of the colonies in Massachusetts down to the time Wigglesworth wrote?

To answer this question, it would have been desirable to have complete lists of deaths each year, classified by age, and frequent and accurate censuses, also classified by ages, neither of which exist. The town records of Massachusetts, however, contain in many instances the age at death; and genealogies (usually based on the records or on deeds or letters) also contain the same information. From these two sources I have constructed three mortality tables (see Table I). The first table (column 1) is based on lives begun and ended in the seventeenth century; the second, on lives born in the seventeenth century; and the third, on lives born in the eighteenth. The method of treating these data was the one ordinarily used where no record of population is available. The quite unusually high expectation of life in infancy and for the years of life before fifteen, is fairly conclusive evidence that the larger part of the infant mortality was not recorded. This might have been expected. Above the age of fifteen, however, there is no reason to suppose an uneven omission of deaths at any particular age,

and the question then becomes this: Are the differences shown by a comparison of these tables with later ones due to a change in the force of mortality, or are they due to a change in age-constitution? Tables constructed according to Halley's method are subject to correction, according to the following scheme: If the population is stationary, the correction is zero; if the population is increasing, the expectation is too small, and must be increased; if decreasing, the expectation must be decreased. This is easily perceived to be true, for, if the population is increasing, there will be a disproportionate number of deaths at the young ages (the age-pyramid will bulge at the bottom), and this will shorten the expectation. Now New England's population was certainly increasing in the seventeenth and eighteenth centuries. Wigglesworth made a correction for this in his own table. The correction is indefinite for lack of statistics of population, but it would need to be made for both of the earlier centuries, and would tend even to increase the expectations given in columns 2 and 3. If this correction affected the table for the eighteenth and the seventeenth centuries in the same way, a comparison of them as they stand is permissible. This is reasonable on its face, and there is not much evidence to the contrary. It will be noted from Table VIII, where the order of the various expectations is given for all the tables discussed in this paper, that the expectation for the seventeenth century was greater than that for the eighteenth for every age from fifteen to forty: the order is reversed for ages forty to seventy, but the earlier century has again the advantage for the rest of life. What evidence can be gleaned from these tables, therefore, would seem to indicate a decrease rather than an increase in longevity from the seventeenth to the eighteenth century. What reason can be assigned for this? A statement in the Report of the Massachusetts Board of Health for 1897 is quite in point, although intended to apply to a later period: "The population of almost any one of the United States differs essentially from the more stationary populations of the old world in the fact that it is constantly being recruited by the addition of considerable numbers of immigrants at the healthy ages of life.

These additions constitute a selected class, not only on account of their age distribution, but also because many of the weaklings must be left behind, in consequence not only of their inability to become wage-earners, but on account . . . of the immigration laws." This was true at the early date for which these tables speak except the last clause. Possibly, therefore, after a hundred years or so the race was not quite so uniformly robust and hardy as it was during the early days. This is merely a tentative explanation.

For every age from fifteen to forty Wigglesworth's table—which was constructed on the same sort of data as mine—shows a lower expectation: from then on it is higher than my tables. This, again, does not indicate a marked increase in expectation: on its face, it indicates a decrease, but I am loath to insist on that interpretation. The changes in mortality during the later periods I have set forth above.

The net result, therefore, which seems derivable from this investigation is that during the last half-century longevity in Massachusetts, and probably in New England, has increased, that from 1793 to 1850 the increase is less certain, and from the seventeenth century to the eighteenth century what data we have point rather to a decrease than to anything else.

I will now give a brief statement of the materials and methods used in constructing my own tables, and try to meet certain objections thereto.

The town records of Massachusetts, as reprinted by the New England Historic-Genealogical Society, together with various family histories, furnished the material.

These town records of Massachusetts are very useful: the idea was originated by the society; and their value as a matter of historical record has been impressed upon the other New England States. Maine passed a law providing for similar work, but it was inoperative. New Hampshire is collecting the records of Concord. The records of some few Connecticut towns are in print. But beyond these there seems to be little prospect of such a work being done systematically for the whole of New England.

The society has in its possession the records of a considerable number of tombstones in Massachusetts, which have been copied by local antiquaries and genealogists into blank books provided for the purpose. These also furnished me some material, especially for the earlier century, and especially those of Copp's Hill and King's Chapel, Boston.

The method followed in manipulating these figures was the tabulation of the ages at death, and the computation from that of the average after-lifetime, or expectation.

Many of the difficulties usually encountered in life-table construction have been avoided, notably the adjustment of the infant mortality; for the records of infant mortality are so incomplete for this early period that almost no significance can be attached to them. Nor was it necessary to go through any adjustment of the population to the age-groups, for the population from which the deaths occurred is necessarily disregarded.

One objection to this method, and possibly a valid one, is that it is possible for a life to be repeated; that is, to be gathered from two different sources, and thus appear twice in the data, and receive twice its due weight in the computations. As to this point, however, it is worth noting that the Seventeen Offices Table, an English table, was based on policies which became claims rather than on lives that ended. Since one person might carry more than one policy, a life in this table could be repeated in the same way. The Encyclopædia Britannica, art. Insurance, says of this table: "The general agreement of the results with those derived from other data referring to persons and not to policies, seems to show, however, that the peculiarity referred to does not materially affect the accuracy of the table as an exponent of the value of assured life." This was probably true also in the case of these tables.

TABLE I.

EXPECTATION OF LIFE.*

Three life tables: (1) from lives begun and ended in the seventeenth century, (2) lives begun in the seventeenth century, (3) lives begun in the eighteenth century.

Age.	(1)	(2)	(3)
0	59.44	58.24	48.81
5	57.17	54.65	47.59
10	52.58	50.02	43.94
15	47.91	45.44	40.27
20	43.43	41.19	37.25
25	39.76	37.45	35.01
30	35.94	33.88	32.21
35	32.23	30.45	29.79
40	28.76	27.07	26.95
45	25.20	23.56	23.79
50	21.84	20.32	20.73
55	18.83	17.25	17.88
60	15.77	14.32	14.84
65	13.14	11.87	12.03
70	10.74	9.45	9.63
75	8.38	7.59	7.46
80	6.44	5.84	5.72
85	5.59	4.72	4.66
90	4.02	3.75	3.10
95	3.34	2.50	2.53
100	.86	.50	.90

*Column (1) is based on the records of 1,632 deaths, taken from Potter's "Concord Lives," and several genealogies; column (2) is based on the records of about 3,500 deaths from the Granary, King's Chapel, and Copp's Hill burying-grounds, Boston, from the New Haven Cemetery, and from several genealogies; column (3) is based on about 4,000 deaths, from the town records of Medfield, Dedham, Medford, Rehoboth, Newton, Northboro, Milton, Millbury, and Medway, and from several genealogies.

TABLE II.

EXPECTATION OF LIFE.

Summary of two life tables: (1) E. B. Elliott, Massachusetts, 1855; * (2) Massachusetts, 1893–97.†

Age.	(1)	(2)	
	Males and Females.	Males.	Females.
0	39.77	44.09	46.61
5	50.17	52.88	54.17
10	47.07	49.33	50.70
15	43.04	45.07	46.53
20	39.86	41.20	42.79
25	36.92	37.68	39.29
30	34.03	34.28	35.85
35	31.01	30.87	32.43
40	27.86	27.41	29.00
45	24.62	23.93	25.54
50	21.32	20.53	22.10
55	18.13	17.33	18.81
60	14.97	14.38	15.74
65	12.12	11.70	12.90
70	9.41	9.34	10.36
75	6.80	7.37	8.29
80	4.95	5.70	6.56
85	3.66	4.31	5.07
90	2.86	3.16	3.73
95	2.26	2.22	2.60
100	1.58	1.21	1.58

* Proceedings of the American Association, vol. xi, p. 51.

† Massachusetts State Board of Health Report, vol. 30, p. 822 (1898).

TABLE III.

DEATH-RATES BY AGES AT VARIOUS DATES IN MASSACHUSETTS.*

Age.	Years.				
	1865.	1875.	1885.	1895.	1900.
0–1	205.28	226.56	212.49	215.89	190.10
0–5	68.62	73.96	67.00	64.51	57.79
5–10	9.63	9.77	7.46	6.23	5.26
10–15	5.14	4.72	3.77	3.18	2.93
15–20	9.63	7.73	6.35	5.34	4.82
20–30	12.58	10.49	9.08	7.08	6.95
30–40	11.68	11.30	10.62	9.67	8.75
40–50	11.68	12.97	12.96	12.65	12.04
50–60	17.49	18.29	19.71	20.45	21.28
60–70	32.90	34.79	36.19	39.37	41.03
70–80	70.48	71.11	76.16	82.41	85.83
80–	168.23	176.41	182.32	184.65	197.82

* Massachusetts Registration Report, vol. lxv, p. 206.

TABLE IV.

SUMMARY OF REV. EDWARD WIGGLESWORTH'S MORTALITY TABLE FROM SIXTY-TWO BILLS OF MORTALITY* (WITHOUT HIS CORRECTIONS FOR INCREASING POPULATION).†

Age.	Expect.	Age.	Expect.	Age.	Expect.
0	28.15	35	28.22	70	10.06
5	40.87	40	26.04	75	7.83
10	39.23	45	23.92	80	5.85
15	36.16	50	21.16	85	4.57
20	34.21	55	18.35	90	3.73
25	32.32	60	15.43	95	1.62
30	30.24	65	12.43	100	—

* Memoirs American Academy, Boston, 1793, vol. ii, p. 131.

† Wigglesworth's correction for the ages up to 15, inclusive, is omitted, so that the table may be strictly comparable with Table I, above, where no correction was possible.

TABLE V.

SUMMARY OF SURVIVAL COLUMNS FOR THREE DIFFERENT PERIODS FOR THE CITY OF BOSTON, PREPARED BY LEMUEL SHATTUCK.*

Age.	Number Surviving.		
	(1811–20.)	(1821–30.)	(1831–39.)
0–5	100.00	100.00	100.00
5–10	66.36	62.96	56.91
10–20	62.82	59.17	52.64
20–30	57.46	54.20	47.56
30–40	43.33	41.12	34.83
40–50	31.11	28.15	23.43
50–60	20.25	18.00	15.45
60–70	13.26	11.29	9.78
70–80	7.58	6.45	5.32
80–90	2.77	2.45	1.90
90–100	.36	.34	.35

* Vital Statistics of Boston, published by Lea & Blanchard, Philadelphia, 1841.

TABLE VI.

SYNOPSIS OF SEVERAL BILLS OF MORTALITY, BY REV. JOSEPH MCKEAN, PRESIDENT OF BOWDOIN COLLEGE.*

(McKean did not put his work into the form of a life table. He gave only the column headed "1x" below. The work of computing the expectation is given below.)

Age.	dx.	1q.	2Px.	2Qx.	Ex.
0–5	2,500	6,576	106,520	491,370	37.36
5–10	337	4,076	78,150	384,850	47.21
10–20	397	3,739	70,810	306,700	41.01
20–30	629	3,342	60,550	235,890	35.29
30–40	457	2,713	49,690	174,340	32.13
40–50	401	2,256	41,110	124,650	27.64
50–60	324	1,855	33,860	83,540	22.52
60–70	433	1,531	26,290	49,680	16.22
70–80	574	1,098	16,220	23,390	10.65
80–90	429	524	6,190	7,170	6.84
90–100	92	95	950	980	5.15
100—	3	3	?	?	?

* Memoirs American Academy, vol. ii, Part II, p. 66.

These data were collected from Roxbury, Marblehead, Stow, Brimfield, Westfield, East Kingston, Barnstable, Hamilton, Exeter, Salem, Edgartown, Beverly (first parish), Ipswich, Salisbury, Montague, Northboro, Hanover, Gloucester, Brookfield (third parish), Cambridge, Fryburg, Wenham, Wilmington, Northampton, Newbury, Reading, Weymouth, West Hampton, Hampton, Dover, Waltham, Newton, Falmouth, West Springfield, Hatfield, Ashburnham, Marblehead (second parish), for different periods, ranging from 1772 to 1790, approximately, with a few earlier records.

TABLE VII.

SUMMARY AND COMPARISON OF PREVIOUS TABLES.

(This table shows, first, the *order* of the values of the expectation of life for the various tables, beginning with the highest, and so on down, Nos. 1, 2, and 3 referring to Table I, columns (1), (2), and (3), No. 4 to the Wigglesworth table, No. 5 to Elliott's 1855 table, and No. 6 to the Board of Health's 1897 table; and, secondly, the *range* of the values of the expectation at each age,—*i.e.*, the difference between the highest and the lowest. This table starts at age 15, as the values below that are too widely divergent to be significant, since the divergence is undoubtedly due to defects of record.)

Age.	Order.	Range (years).
15	1—6—2—5—3—4	11.41
20	1—6—2—5—3—4	9.22
25	1—6—2—5—3—4	7.44
30	1—6—5—2—3—4	5.70
35	1—6—5—2—3—4	4.01
40	1—6—5—2—3—4	2.72
45	1—6—5—4—3—2	1.64
50	1—6—5—4—3—2	1.52
55	1—4—5—6—3—2	1.58
60	1—4—6—5—3—2	1.45
65	1—4—6—5—3—2	1.27
70	1—4—6—3—2—5	1.33
75	1—(4—6)—2—3—5	.92
80	1—6—4—2—3—5	1.49
85	1—2—6—3—4—5	.90
90	1—2—4—6—3—5	1.16
95	2—1—3—6—5—4	1.88
100	5—6—3—1—2—	1.08